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## REVIEWS

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*Invertebrate Paleontology of the Upper Permian Red Beds of Oklahoma and the Panhandle of Texas.* By J. W. BEEDE. (*Kansas University Science Bulletin*, Vol. IV, No. 3, March, 1907, pp. 115-72, Plates V-IX.)

It will be remembered by those familiar with the literature of the Red Beds of the Kansas-Texas region that in 1902 Dr. Beede first described, in this same periodical, a small invertebrate fauna from the Whitehorse sandstone of Oklahoma, concerning which he stated at that time that "there can be but little doubt that the age of these beds is Permian."

It will aid one in understanding the stratigraphy of this region to state that Professor Gould has classified the rocks of Oklahoma, from the base of the Permian upward, as follows:

(1) Enid formation, 1,500 feet thick, which "includes all the rocks of the Red Beds from the base of the Permian to the lowermost of the gypsum ledges;" (2) Blaine, 100 feet thick, containing the lower gypsum beds; (3) Woodward, 425 feet thick, in the upper part of which is the Whitehorse sandstone; (4) Greer, 275 feet thick, containing the upper gypsum beds; (5) Quartermaster, 300 feet thick, which is capped by the Tertiary.

The systematic portion of the present paper contains a further elaboration of the Whitehorse fauna together with a description of a new one from a sandstone in the Quartermaster formation in the Panhandle of Texas. In Professor Gould's classification the Quartermaster division is given as the highest one of the Red Beds and Dr. Beede says that "the fossils came from well up in this formation." It is also stated that the types of the entire Quartermaster fauna were sent Dr. T. W. Stanton, who reported that they were unmistakably Paleozoic.

Dr. Beede says that "these collections are of great importance, as they furnish the final evidence that the Red Beds, below the Dockum beds, of the Oklahoma-Panhandle region are Paleozoic in age. . . . The faunas are somewhat heterogeneous as to origin. Some of the species seem to be directly derived from the Kansas Permian or Pennsylvanian, while others, as pointed out in the discussion of the species, are derived from the European Permian, especially that of Russia." The description of these faunas is an important contribution to American geology, since it relatively determines

the age of a considerable thickness of rocks which heretofore on lithologic and stratigraphic evidence had been "referred to anything from the Permian to the Tertiary."

The discussion of the faunas and the descriptive part are preceded by an excellent "Historical Review" in which the geologic literature of this region is very fully discussed. In this review certain facts are brought out which are important to those interested in the age of the upper Paleozoic deposits of Kansas. It is stated that "Gould has shown that the White-horse sandstone is identical with Cragin's Red Bluff formation of Kansas," which is well toward the top of the Kansan Red Beds. The Wreford limestone of Kansas, which in his later papers the writer has regarded as the provisional base of the Permian, as followed south into Oklahoma, changes into the Payne sandstone that has been traced by Kirk to the vicinity of Norman in the latter state, and is supposed to mark the base of Gould's Enid formation. "Cope, Cummins, and C. A. White have demonstrated that the Wichita (including the Albany) and Clear Fork beds of Texas are unmistakably Permian. . . . Williston and Case have demonstrated that the lower Enid formation of Oklahoma is Permian and of similar horizon to some parts of the Wichita and Clear Fork divisions of Texas."

Dr. Beede states that vertebrate specimens from Cowley County in southern Kansas, described by Dr. Williston in 1897, came from the Garrison formation about fifty feet below the Wreford limestone. Dr. Williston in describing these specimens stated that "we have here an interesting series of forms, so closely resembling the species described by Cope from Danville Ill., that I cannot distinguish them specifically. It would seem to demonstrate the contemporaneity of the two formations, and also that of the Texas Permian, whence the species of all these genera have been described by Cope." The presence of these Permian vertebrates, together with a Permian flora in the Garrison formation, favors its reference to the Permian, and perhaps the Cottonwood limestone at its base is really nearer the line of division between the Pennsylvanian and Permian than the Wreford limestone at its top. The top of this former limestone is near the horizon originally suggested by the writer for a tentative line of division between these two systems. The identification of Permian plants by David White and Sellards, Permian insects by Sellards, Permian invertebrates by Beede, and Permian vertebrates by Williston and Case, from the Kansas deposits which have been referred to the Permian by the writer seem to support the correctness of that correlation and to demonstrate that the base of the Permian is certainly as low as the horizon of the Wreford limestone.

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